to the touch surface, the touch surface can be moved under the influence of the drive electronics to provide haptic feedback to the user.

[0025] As an example, consider the case in which a user dials a telephone number using their cellular phone. Assume that their cellular phone includes a touchscreen such as one described above and below. As the user engages the touchscreen to dial a telephone number, haptic feedback is provided to the user via movement of the touchscreen. This haptic feedback can be designed to simulate a button press. Specifically, by moving the touchscreen in a particular manner relative to the cellular phone's housing, the user feels like they are actually dialing on push buttons.

[0026] The particular manner in which the touchscreen is moved can vary and can be adjustable, in at least some embodiments, in accordance with predefined or definable profiles. For example, movement of the touch screen can occur in different directions, e.g. toward the user a defined distance, away from the user a define distance, and then back toward the user for a movement cycle.

[0027] In the discussion that follows, a section entitled "Example Electronic Device" describes an example electronic device that is configured to provide haptic feedback in accordance with one or more embodiments. Following this, a section entitled "Example Circuitry" describes example circuitry that can be used to implement one or more embodiments. Next, a section entitled "Example Touch Surfaces" is provided and describes some example touch surface structures that can be employed in accordance with one or more embodiments. Following this, a section entitled "Example Method" describes an example method in accordance with one or more embodiments.

Example Electronic Device

[0028] FIG. **1** illustrates an example electronic device in accordance with one or more embodiments generally at **100**. In this example electronic device **100** includes a housing **102** and a touch surface **104** mounted within housing **102**. As mounted, touch surface **104** can move in one or more directions, relative to the housing, under the influence electronic circuitry that is described below. Examples of movement directions are shown by the arrows. In one or more embodiments, directional movement occurs along a vector or vectors that is (are) generally parallel with a plane defined by the top surface of touch surface **104**.

[0029] In this particular example, touch surface **104** resides in the form of a touch screen that can be engaged by a user. FIG. **1** is shown in a cut-away view to expose internal components which are described in more detail in relation to FIG. **2**.

[0030] FIG. **2** illustrates an exploded view of electronic device **100**. In this particular example, the electronic device **100** includes an actuator arm **200**, an actuator array **202**, a subassembly **204** that includes an LCD, various electronics, and a battery assembly, and a front housing **206** that supports touch surface **104**. In this particular example, front housing **206** includes a pair of touch surface connectors **208**, **210**. Touch surface **104** is fixedly mounted to each of touch surface connectors **208**, **210**. In turn, when the electronic device **100** is assembled, the touch surface connectors **208**, **210** are connected to actuator arm **200** by way of a pair of screws that are received in associated apertures in the actuator arm **200**. The actuator arm **200** is fixedly mounted to the actuator array **202** so that when drive electronics (described below) sense a user's movement relative to the touch surface **104**, the actuator array is driven with a voltage or voltages effective to move the actuator arm **200** and hence the touch surface **104** by way of the touch surface connectors **208**, **210**. Doing so provides haptic feedback to the user through the touch surface. By using the illustrated actuator array **202** and by effecting movement of the touch surface **104** along a vector or vectors that are generally parallel to the plane of the top surface of touch surface **104**, the elevational thickness of electronic device can, in at least some embodiments, be reduced. Specifically, the illustrated actuator array **202** constitutes a departure from previously employed collapsible dome technologies which required elevationally thicker devices.

[0031] It is to be appreciated and understood that the particular arrangement and order of the components shown in FIG. **2** is to provide but one example of how various components can be arranged within a suitably-configured housing. Accordingly, other arrangements and component orders can be utilized without departing from the spirit and scope of the claimed subject matter. Other arrangements can include, by way of example and not limitation, mounting the actuator or actuators around the perimeter edges of the touch surface, anywhere below the touch surface, and/or mounting the actuator or actuators to a mass within the device to create movement, to name just a few possibilities.

[0032] Further, in at least some embodiments, actuator array **202** can be connected to other different components within the electronic device in order to impart a different haptic feedback experience. For example, in at least some embodiments a so-called floating battery arrangement can be used in which the actuator array **202** is fixedly connected to the device's battery which is movably mounted within the device's housing. Haptic feedback can be provided to the user by moving the battery under the influence of the actuator array **202**.

[0033] FIG. **3** illustrates the actuator array **202** in more detail in accordance with one or more embodiments. In the view shown in FIG. **3**, each side of the actuator array **202** is shown. The left-most view illustrates the side of the actuator array shown in FIG. **2**; the right-most view illustrates the reverse side of the actuator array **202**. In this example, the actuator array **202** includes an actuator frame **300**, an electrically-deformable region **302**, such as EAP, that is driven by the drive electronics described below, and an actuator disk **304** that is fixedly mounted to corresponding regions on actuator arm **200** (FIG. **2**). Any suitable number of electrically-deformable regions can be employed. In the illustrated example, six electrically-deformable regions are employed and mounted on the actuator frame **300**. In addition, multiple different actuator frames can be employed in a stacked arrangement to increase the force with which movement occurs.

[0034] FIGS. **4** and **5** illustrate different views of electronic device **100** with various portions of the structure removed to show detail.

[0035] FIG. **4** illustrates the electronic device with its housing **102** (FIG. **2**) removed. Actuator arm **200** is shown mounted on actuator array **202**. FIG. **5** illustrates the electronic device in a cut-away view as seen from the front of the device where a portion of touch surface **104** is shown. In this example, actuator array **202** is shown in its disposition relative to touch surface connectors **208**, **210**. Recall that the actuator arm **200** (FIG. **4**) is fixedly mounted to the actuator